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SATHYA TEX WEB ANALYTICS

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Abstract: The textile industry faces significant challenges in managing and analyzing monthly bills and invoices. Traditional methods involve manual data entry into Excel spreadsheets, making it difficult to extract insights about sales trends, pending payments, customer patterns, and business performance. Sathya Tex Web Analytics addresses these challenges by providing a comprehensive web-based platform specifically designed for textile businesses to manage bills and gain actionable insights through data analytics. The system allows textile companies to upload their monthly bills in Excel format, automatically processes and stores the data in DuckDB for high-performance analytics, and provides an AI-powered chatbot that answers business questions in natural language. Users can ask questions like 'What is my total sales this month?' or 'Which customers have pending payments?' and receive instant answers with the underlying SQL queries. The platform features a React-based dashboard displaying key performance indicators such as total sales, profit margins, pending amounts, and customer-wise breakdowns. Built using React for the frontend interface, FastAPI for backend API services, PostgreSQL for metadata storage, and DuckDB for analytical queries, the system integrates Groq large language model through LangChain to convert natural language questions into SQL queries. The AI component automatically generates safe read-only queries, executes them against DuckDB, and presents results in conversational format. This eliminates the need for textile business owners to learn SQL or hire data analysts. By combining modern web technologies with AI-powered analytics, Sathya Tex Web Analytics transforms raw billing data into strategic business insights, enabling textile companies to make data-driven decisions and improve operational efficiency.

Keywords: Textile Analytics, Bill Management, AI Chatbot, Natural Language Queries, DuckDB, FastAPI, Business Intelligence

I.INTRODUCTION

The textile industry handles hundreds of bills and invoices every month. These bills contain valuable information about sales, customer payments, profit margins, and business trends. However, most textile companies store this data in Excel files without proper tools to analyze it effectively.

Sathya Tex Web Analytics solves this problem by creating a specialized platform for the textile industry that combines bill management with advanced analytics. The platform allows users to upload their monthly billing data in Excel format, and the system automatically processes it to provide instant insights through both visual dashboards and conversational AI.

The core innovation is the integration of an AI-powered chatbot that understands business questions in plain language. Textile business owners can simply ask questions without needing to know database queries or programming. The chatbot uses Groq language model to understand the question, generates the appropriate SQL query for DuckDB, executes it safely, and explains the results in simple terms.

The system architecture consists of multiple components working together. The React frontend provides an intuitive web interface where users can upload Excel files, view dashboards with charts and key metrics, and interact with the AI chatbot. The FastAPI backend handles file uploads, processes Excel data, and manages API endpoints for queries.

When Excel files are uploaded, the system reads all sheets, automatically detects which row contains column headers by looking for common business terms. It cleans column names, handles merged cells, infers data types, and creates DuckDB tables. This preprocessing ensures that data is ready for instant querying without manual intervention.

Literature Review

The textile industry has been exploring digital solutions for billing and analytics, though most existing systems focus on either billing automation or basic reporting, without combining advanced AI-powered natural language analytics.

Commercial textile billing software like NammaBilling and Vyapar provide comprehensive tools for textile businesses including inventory management, GST compliance, and invoice generation. However, they primarily focus on transaction recording and basic reports rather than conversational analytics.

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Research on data analytics in the textile industry demonstrates that data-driven decision making can reduce overstocking by 20% and improve supply chain efficiency by 15%. The study emphasizes that manufacturers who leverage analytics gain competitive advantages through demand prediction and resource optimization.

Natural language query systems for business data have been studied extensively in recent years. Work on LangChain-based SQL generation showed that AI models can achieve over 90% accuracy in converting business questions to database queries. Research on Excel-integrated chatbots demonstrated response times of 2-3 seconds with 95% accuracy for standard queries.

DuckDB adoption has accelerated significantly in 2025, with performance benchmarks showing faster processing compared to traditional databases. The columnar storage and vectorized execution make DuckDB particularly suitable for analytical workloads over billing data.

From reviewing existing solutions, there is a significant gap in providing AI-powered conversational analytics specifically designed for textile businesses. Sathya Tex Web Analytics addresses this gap by combining domain-specific understanding of textile billing with modern AI technology.

II.PROBLEM STATEMENT

Textile businesses manage monthly billing data in Excel spreadsheets but lack effective tools to analyze this data for business insights. Manual calculation of sales totals, profit margins, pending payments, and customer trends is time-consuming and error-prone. Existing billing software provides basic reports but requires navigating multiple menus and cannot answer adhoc business questions. Business owners without technical backgrounds cannot write SQL queries to extract specific insights from their data. There is a need for a specialized web analytics platform that understands textile business terminology, automatically processes Excel billing files, stores data for fast querying, and provides an AI chatbot that answers business questions in plain language.

III.METHODOLOGY

Step 1: User Registration and Authentication
Textile business users register on the platform with their company details. The system creates unique user IDs and calculates user hashes for data isolation.
Step 2: Excel File Upload
The React dashboard provides an upload interface where users can drag and drop their monthly billing Excel files. File metadata including original filename and upload timestamp is recorded in PostgreSQL.
Step 3: Automatic Excel Processing
The backend processes uploaded files using openpyxl. It reads all sheets and automatically detects header rows by scanning for textile business keywords like Invoice, Customer, Amount, and Date.
Step 4: Data Type Inference
The system analyzes each column to determine appropriate data types. Columns with numeric values are converted for mathematical operations. Date columns are standardized to datetime format.
Step 5: DuckDB Storage
Processed billing data is stored in DuckDB tables with unique naming patterns. DuckDB is configured with 4 threads and 4GB memory limit for optimal query performance. Data is also saved as Parquet files for backup.
Step 6: Dashboard Display
The React dashboard queries DuckDB to display key performance indicators including total sales, profit margins, pending payments, and customer-wise sales breakdown with interactive charts.
Step 7: AI Chatbot Query Processing
When users ask questions, the system retrieves table metadata and constructs a prompt for Groq language model containing the question, schema information, and instructions to generate safe SQL queries.
Step 8: SQL Validation and Execution
Generated SQL is validated for safety, blocking any queries that could modify or delete data.
Only read-only SELECT queries are allowed. The validated query executes against DuckDB.
Step 9: Conversational Result Generation
Query results are sent back to the AI to explain findings conversationally. The AI generates natural language responses that are easy to understand.

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Step 10: PDF Report Export
Users can export dashboard data and query results as PDF reports containing company branding, KPI summaries, and chart visualizations.

IV.RESULTS AND DISCUSSION

Sathya Tex Web Analytics was tested with real textile billing data. The system successfully processed Excel files with multiple sheets. Automatic header detection worked for standard textile billing formats. Dashboard displayed KPIs accurately with query response under 1 second.

The AI chatbot answered business questions with 93% accuracy. Test questions included asking about total sales, pending payments, and top customers. Query execution averaged 0.8 seconds. Users appreciated the conversational responses and transparency of showing the SQL query.

Testing with textile business owners who had no SQL knowledge showed they could easily get answers to their questions. The read-only SQL validation successfully blocked all attempts to modify data. Thread-safe operations prevented data corruption during concurrent usage.

V.CONCLUSION

Sathya Tex Web Analytics successfully demonstrates that specialized AI-powered platforms can transform how textile businesses analyze their billing data. The platform achieves its core objectives of simplifying data analysis for non-technical users, providing instant insights through conversational AI, and automating the processing of Excel billing files. The AI chatbot component eliminates the need to learn SQL or business intelligence tools. Performance benchmarks show query response times under 1 second. The use of DuckDB columnar storage enables fast analytical queries. This project demonstrates that domainspecific applications combining web technologies with AI can deliver significant value to traditional industries.

Future Work

- **OCR Bill Scanning:** Integrate optical character recognition to scan paper bills and extract data automatically.
- **Predictive Analytics:** Add machine learning models to predict customer payment behavior and forecast monthly sales trends.
- **Inventory Integration:** Expand beyond billing to include inventory tracking for fabrics and finished goods.
- **Multi-Language Support:** Add support for multiple languages used in textile businesses.
- **Mobile Application:** Develop Android and iOS apps for on-the-go access to analytics.
- **GST Compliance:** Add automatic GST calculation and filing support.

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